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The Climatology of the United States*

It is now nearly seventy years since the publication of Blodget's classical *Climatology of the United States*, and in all that long interval no similar descriptive work has appeared dealing on a uniform plan with the whole of the area. There has been a vast accumulation of reliable statistics, and a large number of books and papers have dealt with local areas or special elements of the climate, but the only book which attempted a comprehensive treatment—A. J. Henry's *Climatology of the United States* (1906)—was an official publication of the United States Weather Bureau and was almost entirely statistical. A new descriptive climatology was therefore overdue, and Professor Ward has supplied the need in a very satisfactory manner.

To write a description of the climate of a large area which shall be full and accurate, and at the same time readable, is not an easy task, and would be impossible to any one who had not a close personal acquaintance with the weather of all parts of the country. Professor Ward has the knack of combining scientific accuracy with practical illustrations—as in his advice to campers in mountain regions to locate their fires on the downhill side of their camp, so that the descending flow of cold air will carry the smoke away from the camp. He also avoids long and indigestible masses of figures, the few tables he gives being of the simplest possible nature; instead he presents the

* R. de C. Ward. *The Climates of the United States.* $8\frac{1}{4} \times 5\frac{3}{4}$, pp. xvi. +518 (*illus.*), Boston, U.S.A., Ginn and Co., 1925, 4 dollars.

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statistical matter graphically in the form of curves and charts. This omission of tables is justified because any one requiring detailed figures is given full references to the numerous publications of the U.S. Weather Bureau.

The book contains 23 chapters, beginning with an historical introduction and passing from the major climatic controls to the climatic provinces of the United States, and then to the weather element in climates. The latter chapter is illustrated by typical weather charts and by reproductions of barograms and thermograms. Chapter V. deals with temperature; as the extremes range from below $-60°$ F. to 134° F. there is much to be said about this subject.

Chapter VI. discusses the important subject of frosts, and Chapter VII. the prevailing winds. The next three chapters are devoted to rainfall; here again the most varied conditions are met with in different parts of the country. In Chapter XI., snowfall, there is much matter of great interest in connexion with snow surveys and the economic importance of snowfall for agriculture in dry regions. The annual snowfall of 800 inches on the mountain somewhat inappropriately christened Rainier must be very near a world's record. Chapter XII. deals with humidity, evaporation and "sensible temperatures"; the material here is less complete than that for most other elements. Chapter XIII. deals with sunshine, cloudiness and fog; in connection with the latter element it is interesting to note that the U.S. Weather Bureau apparently realised the need for a definite criterion of fog as early as 1894, and adopted a visibility of 1,000 feet as the limit of dense fog. The charts of "dark days" due to the smoke from forest fires are also of great interest; one finds it hard to realise that the smoke from a forest fire can cause a "dark day" 2,000 miles away.

Chapter XIV. deals with thunderstorms, for which, owing to the practice of insurance against lightning, the statistics are very complete. The next chapter describes those "peculiarly and characteristically American" phenomena, tornadoes; then we have: cold waves, northers and blizzards; hot waves and the "Indian Summer"; hot winds and Chinook winds; land and sea breezes and mountain and valley winds. We are told that the cold waves of the eastern United States are also unique and typically American; they are simply the cold northerly winds in the rear of a depression, but their intensity is due to the peculiar conditions in North America. The Chinook is the Föhn wind of Montana, in which a rise of 31° F. has been recorded in three minutes.

In Chapter XX. the essential characteristics of the United States climates are reviewed, district by district. Chapters XXI. and XXII. deal with the practical subjects of climate and

health, and climate and crops; it is curious that no reference is made to the views of Ellsworth Huntington on the effect of climate on efficiency. The final chapter gives a brief description of the climate of Alaska.

There is a good index to the text, but this would have been more valuable if it had included also the numerous references given in the footnotes. The printing is excellent, and the illustrations are for the most part clear, although some of the line-blocks are confusing. The lithographed rainfall map which forms the frontispiece is both clear and artistic.

The Cierva Autogyro

By E. Taylor, M.A., B.Sc.

Señor Don Juan de la Cierva's Autogyro, marking a new departure in aerial navigation, has been brought prominently to public notice by reason of its successful trials at the Royal Aircraft Establishment, Farnborough, on October 12th, 1925. The success of the machine dates, however, from 1923, since when repeated flights have been made in Spain and in France. Tribute must be paid to the patient research of the inventor, whose ultimate triumph was won only after many flying accidents. Between 1920 and 1923 he carried out some thirty-two reconstructions, embodying five types of machine.

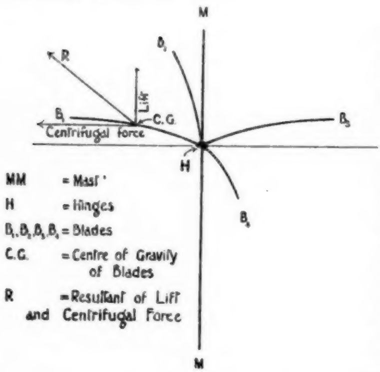
The autogyro resembles an aeroplane in having a fuselage, engine and propeller. It differs from an aeroplane in having a four-bladed wind vane instead of wings as ordinarily understood. There are certainly ailerons fitted to the fuselage, but their function is simply to provide lateral control. The wind vane is the characteristic feature of the autogyro, and is in effect a system of wings which rotate in ball bearings about a mast fixed in front of the pilot vertically with respect to the machine in normal straight flight, but capable of some adjustment about the vertical. The vane is not driven by the engine. A number of men, by pulling on a rope, provide an initial speed of revolution with the machine stationary, after which, the blades having a positive incidence to the plane of rotation, the vane rotates freely in the air stream generated by the forward motion derived from the propeller, and so supports the machine in the air.

The manhandling operation is not essential, and is undertaken simply because an initial speed of revolution reduces the length of run required. The autogyro is not a helicopter—at least, not yet—and requires a certain "take off" in the same way as an aeroplane. Its achievement consists in its low minimum speed and in its ability to land at angles considerably steeper than 45° with a landing run of the order of 50 feet.* With an

* In one test the measured landing run was 39 feet.

undercarriage suitably designed to take landing loads an almost vertical descent is practicable.

One might suppose here that the simplicity of the principle caused it to elude for so long the wit of inventors. As a matter of fact, however, the machine is not airworthy with blades rigidly fixed to the central mast, and it was not until Señor de la Cierva's unsuccessful experiments with such blades forced him to adopt the device of hinging the blades separately to the central mast, that the autogyro became practicable from the stability point of view.



This modification, by giving each blade a degree of freedom vertically, enables it to set itself according to the resultant (R) of lift and centrifugal force. Without this accommodation, since the resultant force is greater on a blade revolving into the wind than on the opposite blade, there is an unbalanced moment on one side of the machine making for instability, which evinces itself as a roll. There seems to be no reason, indeed, why such an unbalanced moment would not overturn the machine altogether.

When not rotating, the four hinged blades are supported from the mast by shock absorbers. They are also connected at points about half-way along their span by weighted wires whose function is to equalise stresses in the blades. It is noteworthy that, when the blades are not revolving, there is nothing except their weight to prevent them from folding up altogether when subjected to upward pressure. In flight they are maintained by centrifugal force in an approximately horizontal position.

Meteorological factors may be of some importance here, in that an abrupt discontinuity in wind force and direction resulting in a sudden considerable increase in lift, without an immediate change in centrifugal force, might cause abnormal lifting of the blades. It is thought, however, that no discontinuity would be sufficiently violent to involve risk on this account.

An interesting point is that the surface wind, though it matters little for taking off with the autogyro, is of importance in landing so long as the undercarriage is designed only for a forward run. For the pilot, having reduced his forward speed to make an

approximately vertical descent, might find himself landing backwards in a moderate surface wind. During tests, the Meteorological Office, Farnborough, was frequently called upon to measure surface wind speed on the aerodrome, and to give wind data up to 2,000 feet at intervals of 500 feet. On one occasion data were given for every 200 feet.

OFFICIAL PUBLICATIONS

THE following publications have recently been issued :—

GEOPHYSICAL MEMOIRS—

No. 27. *On the design of the Kew Pattern Barometer.* By S. N. Sen, Ph.d. (M.O. 254*g*).

The Kew pattern mercury barometer was introduced about the middle of last century to provide a means of obtaining accurate measurements of atmospheric pressure at sea. To prevent undue " pumping " the tube must be designed in such a way that oscillations of short period are damped out while long period variations are unaffected.

The present paper deals with the principles which should govern the design of the tube and cistern of the barometer in order to secure the desired results. The problem is considered from the practical as well as from the theoretical standpoint, and the paper includes data and diagrams prepared for the purpose of assisting the maker in selecting tubes which will give the specified falling time.

PROFESSIONAL NOTES—

No. 43. *Some effects produced by protective shields on the readings of grass minimum thermometers.* By J. M. Stagg, M.A., B.Sc. (M.O. 273*c*.)

The results of the five series of experiments carried out at Kew Observatory may be summarised as follows. Any form of screen in the vicinity of a grass minimum thermometer will result in an increase of the temperature recorded even if the screen is only on one side of it. If any screen has to be used it is desirable that the wires should be as thin as possible.

Discussions at the Meteorological Office

December 7th, 1925. *Ozone as an absorbing material for radiations in the atmosphere.* By C. Fabry. (Pub. Mass. Inst. Tech., No. 281, 1925, pp. 20). *Opener*—Mr. C. E. Britton, B.Sc.

This paper contains the results of the author's investigation into the ultra-violet region of the solar spectrum. It is well

known that there is strong atmospheric absorption in this region beginning at about 3100 A. The intensity of the spectrum begins to fall away rapidly at this point as we go towards the shorter wave lengths, and at 2900 A very little radiation reaches the earth's surface. Ozone possesses a very strong absorption band in this region, and in order to ascertain whether the observed atmospheric absorption could be attributed to this gas a careful examination was made of the absorption spectra of gaseous ozone and of the atmosphere. As a result, the author concludes that the absorption of the atmosphere can be definitely attributed to ozone. He deduces that the thickness of this gas present in the atmosphere is about 3 mm. and that the amount seems independent of the meteorological conditions.

The next point discussed is the location of the ozone in the atmosphere. Chemical analysis and the investigations of Lord Rayleigh shew that the amount of the gas present in the lower layers is extraordinarily minute, being only about 5 per cent. of the quantity which would be expected if the whole of the ozone were uniformly mixed in the atmosphere. It must therefore be situated in the higher layers, where it is probably formed by the ozonizing effect of waves of very short wave length. These short wave lengths are absorbed very rapidly by oxygen and do not penetrate lower than 40 km.

The subjects for discussion for the next meetings will be:

January 18th, 1926. See p. 258. *Opener*—Sir Gilbert Walker.

February 1st, 1926. *Solar radiation and weather or forecasting weather from observations of the sun.* By H. H. Clayton (Smithsonian Misc. Coll. 77, No. 6, pp. 64). *Opener*—Capt. H. F. Jackson, M.S.E.

February 15th, 1926. *Die reduzierte Laufzeitkurve und die Abhängigkeit der Herdtiefe eines Bebens von der Entfernung des Inflexion-spunktes der primären Laufzeitkurve.* By S. Mohorovičić (Beitr. z. Geophs. xiii., pp. 217-40, xiv., 1915, pp. 187-198); and *Über die Konstitution des Erdinnern, erschlossen ans Erdbebenbeobachtungen.* By B. Gutenberg (Phys. Zs. xiv., 1913, pp. 1217-8). *Opener*—Dr. H. Jeffreys, F.R.S.

Royal Meteorological Society

THE monthly meeting of this Society was held on Wednesday, December 16th, at 49, Cromwell Road, South Kensington. Mr. C. J. P. Cave, M.A., J.P., President, in the Chair.

I. D. Margary, M.A.—The Mursham Phenological Record in Norfolk, 1736-1925, *and some others.*

The paper analysed a remarkable phenological record kept by

five generations of one family at Hevingham, near Norwich, over a period of 190 years with one break of 25 years after 1810. The observations include the dates of leafing of 13 common trees, flowering of snowdrop, hawthorn, etc., and the movements of 8 migrant and other birds. The mean date for a group of seven of the plant events covering the period January to May was worked out for each year, and it was found that the annual variations of this date are closely related to the temperature variations, and there is also a periodicity of twelve years in the lateness or earliness of the springs; the next late spring is due within a few years. A similar but less marked periodicity is shown by the mean temperature at Greenwich for January to May. There is also an indication that in recent years (1891 to 1925) spring has come earlier than in the eighteenth century (1751-85). Migrant birds seem independent of these conditions; the cuckoo has maintained a fairly regular date of arrival, with some variation according to the temperature, but the swallow tends to arrive later than formerly, the average date for the period 1891-1925 being eight days later than for 1751-85.

C. D. Stewart, B.Sc.—Experiments on the shielding of Rain gauges.
The chief difficulty met with in the measurement of rainfall is the effect of wind in decreasing the catch of a gauge owing to the eddies set up by its projecting parts. This paper gives an account of experiments which have been in progress for some years at Valencia Observatory to test the efficacy of different methods of shielding a rain gauge from such eddies. It has been found that protection is afforded in varying degrees by buildings, the Nipher Shield, and pits. Analysis of the traces of self-recording rain gauges has been carried out to obtain quantitative estimates of the value of the different types of protection.

H. Jeffreys, F.R.S.—On the dynamics of Geostrophic Winds.
It is shown that all problems of the motions of the atmosphere produced by temperature changes of large horizontal extent can be reduced to closely related problems of tides in an ocean of uniform depth. These problems, in the absence of friction, can in general be solved by known methods. The theory is applied to the annual variation of pressure in Central Asia, and gives fair quantitative agreement. When applied to the general circulation, however, it is found to give easterly winds everywhere, contrary to observation. It appears that friction would considerably alter this result, and on examination it is found that a steady circulation is impossible when friction is present. The only dynamically admissible types of motion with friction involve westerly circulations around the poles and systems of cyclones whose height is comparable with that of the tropopause.

Correspondence

To the Editor, *The Meteorological Magazine*

The Mildness of Winters on the North Wales Coast

I feel that the following temperatures taken in the Stevenson screen in my garden here may be of interest to readers as it possibly is not realised how mild this coast usually is in winter. The screen is on low level ground at about 25 feet above the sea and half a mile from it. It would be interesting to know whether many places on the south coast of England could show higher winter minima during the six winters for which I give particulars.

WINTER.	Number of Readings.		
	32°F. or below	29°F. or below	Below 25°F
1919-1920	11	4	—
1920-1921	16	5	3
1921-1922	24	12	—
1922-1923	4	1	—
1923-1924	22	5	—
1924-1925	5	3	—

Since writing the above we have participated in the usually prolonged frost of this month, having had eleven readings 32°F. or below, but with a mean minimum of not lower than 29·6° F. and an absolute minimum of 25·4° F. on the 21st.

S. WILSON.

Trem-y-coed, Sea Road, Abergele. November 24th, 1925.

Crepuscular Rays

With reference to the notes on Crepuscular Rays which have appeared in the September and December *Meteorological Magazine,* the following record was observed by my brother Herbert Priestley on the evening of September 9th.

The appearance of the sky as seen from Gourock (Renfrewshire) was very impressive. Rain had been falling during most of the day, but towards evening the sky cleared and there were some very unique effects.

Just as the sun was setting a dark belt of low cumulus cloud lay along the western horizon. It stretched well overhead. Intervening clouds were brilliantly illuminated against the dark background. On the eastern horizon a very curious effect was observed. Rays of light seemed to emanate from a point exactly opposite the sun. Each ray was not unlike a search-

light. They stretched upwards to about 45°. Those to the south were clearer than those to the north. A belt of cumulus was illuminated by the sun's rays, but the eastern rays referred to above were visible against the cloud, causing it to be light and dark alternately.

From the point of observation, Gourock Pier (L.M.&S. Rly.), the lower part of the eastern horizon was dark and probably hazy owing to the smoke of Glasgow and other industrial centres in that direction.

CHARLES F. PRIESTLEY.

49, Brisbane Street, Greenock. October 30th, 1925.

A Remarkably Quick Change of Visibility at Cranwell, Lincolnshire

During the morning of October 8th, 1925, there occurred here at Cranwell, Lincolnshire, a remarkably quick change in the horizontal visibility which seems worthy of notice. The visibility at 7h. was 6¼ miles, but it fell away to barely 2¼ miles and so persisted up to 10h. 20m. Within ten minutes, however, it rose abruptly to 13 miles, and persisted at 13 miles or more, up to 18h., the change being so sudden as to evoke general comment.

The explanation of the abrupt and big rise in the visibility seems to be found in the setting up of intense upward convection currents. That these currents were in existence is shown by three independent lines of evidence as follows: (A) At 10h. the sky was three-quarters clouded, the only cloud types present being alto-cumulus and alto-stratus, but nearer to 11h. there was a fine display of castellated cumulus (base 2,000 ft. high) half covering the sky; (B) a "tail method pilot balloon ascent" made at 11h. revealed the presence by direct measurement of upward currents of great velocity; and (C) R.A.F. pilots flying machines over the aerodrome at Cranwell thought the "bumpiness" (a sure sign of upward currents) so remarkable as to merit special report.

It would be a matter of great interest to know whether any similar abrupt and big increases in visibility have been noticed by other observers, and, if so, whether they were accompanied by similar heavy convection currents upward.

W. H. PICK.

R.A.F. Cadet College, Cranwell, Lincolnshire.

Thunderstorm at The Hague, December 10th

After a long period of severe frost and snow when the thermometer fell to 15 degrees and below in the screen, and snow covered

the ground for more than two weeks, a slow but decided thaw set in here early this week as the large depression centred to the south of Iceland moved slowly southeastwards, gradually replacing for the time being the Central European anticyclone. During yesterday (December 10th) the westerly wind became squally with showers of rain in the early morning. The day was fair with some sunny intervals, but the evening became stormy with driving rain and increasing wind. The thermometer rose gradually all day until at 8 p.m. it stood at 43 degrees. By that time the centre of the depression was situated near the entrance to the Skagerrak, and small secondaries were passing across England and Holland.

At about 7.50 p.m. rain descended with torrential force and the wind increased to gale strngth. At almost exactly 8 p.m., I was startled by a violent clap of thunder. After this at regular intervals of about 3 minutes, very vivid flashes of lightning occurred with simultaneous claps of thunder and the rain descended with great force. The wind shifted from W to WNW at about 8.15 p.m. and the rain eased considerably. By 8.30 p.m. the storm was over, the wind abated to a light breeze and the sky became clear. The air felt distinctly warmer after the storm than before it, in spite of the veer of wind.

This thunderstorm was very local, no thunderstorm occurring in Rotterdam, which is under 20 miles from the Hague.

J. E. COWPER.

Schiekade, 12, The Hague. December 11th, 1925.

NOTES AND QUERIES

Measurement of Planetary Radiation

A paper by W. W. Coblentz and C. O. Lampland bearing this title published as *Bulletin* No. 85 of the Lowell Observatory, gives an account of some preliminary researches into the composition of the radiation received from the moon and the planets. This consists of two parts, solar radiation reflected directly to space, and "planetary" radiation sent out by the surface and atmosphere of the planet itself. The radiation from the different planets was measured first as received and then after passing through a water cell 1cm. in thickness, which absorbs all radiation of more than $1{\cdot}5\mu$. Since this is above the wave-length of almost all the reflected solar radiation but below that of the planetary radiation, the difference gives a rough measure of the latter. The percentage absorbed was found to be: Moon 80, Mars 30, Saturn 15, Venus 9, Jupiter 3; that is, the greater part of the radiation received from the moon is due to the heating of its surface by the sun, but practically all that received from

Jupiter is reflected solar radiation. This latter conclusion is rather surprising since the albedo of Jupiter is only 0·56, so that nearly half the solar radiation is absorbed and must be again emitted as planetary radiation. In addition it is generally believed that Jupiter is still radiating its own heat.

The reason for the discrepancy is that the long-wave planetary radiation is largely absorbed by the terrestrial atmosphere before it reaches the radiometer, whereas the reflected solar radiation is little affected. The greatest loss is suffered by the radiation emitted by the planetary atmospheres rich in water-vapour; radiation from the actual planetary surface is less liable to absorption. If the atmosphere resembles that of the earth, the percentage of the planetary radiation reaching the radiometer will be small. Hence the investigation gives valuable information as to the nature of the atmospheres in the different planets. Jupiter and Venus evidently resemble the earth closely in the presence of much water-vapour in their atmospheres. The very low value for Jupiter points also to a low temperature of the radiating surface, which causes much of the planetary radiation to lie outside the limits recorded by the radiometer. The Martian atmosphere is much less absorptive, while the moon has little or no air, so that the two latter send us radiation direct from their surfaces.

A later article by Dr. W. W. Coblentz (*Nature*, September 26th, 1925, p. 472) deals with radiometric determinations of the temperature on Mars in 1924. In studying the seasonal changes it was found that the temperature of the south polar regions rose from $-60°$ C. in July to $10°$ C. or even higher at the Martian summer solstice (on October 5th), while the temperature of the north polar regions remained near $-70°$ C., as was to be expected with winter on this hemisphere. The observed high surface temperatures on Mars may be accounted for on the assumption that these dark areas contain vegetation having the properties of the tussock mosses and lichens of our dry tundra, which have a high absorptivity for solar radiation and a low thermal conductivity. This assumption is in agreement with the visual observations and with the lower intensity of insolation on Mars. The observations also indicate that at noon in summer temperatures of 40° to 60° F. prevail.

Note on the Accuracy of the Pressure Record given by Dines Type of Baro-Thermograph

It is well known that the measurement of pressure by means of an aneroid box is subject to uncertainty on account of a hysteresis effect in the material of which the box is made. This causes it to respond to pressure changes in a sluggish manner, and in con-

sequence the instrument shows different readings as between a falling and a rising pressure, especially so when the range of pressure variation is large. This defect, commonly known as lag, is troublesome with instruments used for upper air observations, in which pressures as low as 40 mb. absolute are sometimes required to be accurately measured.

The results of some recent experiments with the Dines type of baro-thermograph, as at present used by the Upper Air section of Kew Observatory, are given below. Two definite sets of tests were made, one to determine the total lag, or difference in the pressure readings of the instrument as between a falling and rising pressure, the other to determine the difference in the pressure readings as between a rapid fall of pressure, and a slow one such as occurs in the case of an actual balloon ascent. In all cases the pressure was reduced steadily from one atmosphere to a minimum of 70 mb. In the first set of tests the total lag was found to be practically the same whether the reduction and subsequent rise of pressure was effected in 13 minutes or 1½ hours, and the values are set out in the following table :—

Pressure at which readings were taken.	Atmosphere.	780 mb.	470 mb.	170 mb.
Total lag.	About 1·5 mb.	2·7 mb.	3·1 mb.	3·2 mb.

In the second set, slow and fast reductions of pressure were made taking respectively 1 hour and 8 minutes ; they showed that under the slow reduction the aneroid box expanded on the whole a little more than under the fast one. The difference was trifling at pressures above 300 mb., below that it was such as to cause a difference of the order of 1 or 1½ mb. as shown on the pressure scale.

The conclusions reached are satisfactory and indicate the precision obtainable with instruments of the type under consideration when care has been taken to ensure correct adjustment of the recording mechanism ; the lag is greatly increased if the scribing point be allowed to bear too heavily on the plate, or if the point itself be too sharp. It follows that the calibration of these instruments may safely be performed at a comparatively fast rate (thereby saving a great deal of time), without running the risk of setting up a false standard of comparison with the actual ascent, and also that the lag due to the friction of the scribing point and the hysteresis of the aneroid box can with due care be made very small, and if desired can largely be allowed for.

The aneroid boxes fitted in the instruments under test are of the ordinary type, partially evacuated of air as is usual in the Dines baro-thermograph ; they are, however, spun up from German silver sheet which has been specially prepared before-

hand. The essential feature would seem to be that the material must be uniform in texture and in a moderately hard state before the corrugations are formed in the discs. The two halves of the box are fastened together in the usual manner, but using a minimum quantity of soft solder; otherwise no special precautions are taken in manufacture.

Pilot Balloon Ascents in Colombo

With reference to the editorial note on this subject published in the *Meteorological Magazine* for August, 1925, p. 164, Mr. Jameson writes that it was found more convenient to estimate the apparent lengths of balloon tails with a grid of wires (spider webs) placed in the field of the telescope rather than to measure them with the micrometer of the theodolite. The wires were spaced at intervals corresponding to a complete revolution of the micrometer head, or ·00169 of a radian. This interval is reckoned as 10, and the apparent length of a 20 metre tail is estimated, generally, to units and half units. When the balloon is a great distance away, estimates are necessarily crude, but the observations are sufficient to guard against gross errors caused by the adoption of a mean rate of rise in the case of a descending or non-ascending balloon. An error of 10 per cent. or even 20 per cent. in this mean rise is less than the uncertainty of the theoretical rise at high altitudes, and even with apparent tail lengths as low as 5 units an error of 20 per cent. in the deduced mean rise is unlikely.

Mr. Jameson thinks that the interrupted rise shown on the curve for May 22nd is real, and adduces a flight on September 8th which indicates a halt for about 13 minutes at a level of 250 to 300 metres followed by a steady rise to above 2 km. This day was remarkable for the absence of fracto-cumulus. These clouds are presumably due to turbulence in the lowest layers of the monsoon currents and they generally move at a minimum height of about 500 metres. At the time of flight the air would have been saturated at 600-700 metres, and the obvious suggestion is that the downward currents indicated at about 0·3 km. of the order of 1·5 m/s., opposing the upward travel of the air particles due to turbulence, were sufficient to reduce the total upward movement below the limit necessary for condensation, and hence were responsible for the disappearance of the fracto-cumulus.

Expansion of a Pilot Balloon

As a possible means of improving Pilot Balloon Ascents, it was suggested by Mr. A. E. Mayers that a suitable valve be fitted into the nozzle of the Pilot Balloon in order to allow gas to escape when the balloon had attained a predetermined height. This

suggestion rests on the assumption that the excess of the pressure of the enclosed gas over that of the surrounding air continually increases and that, finally, the rupture of the fabric occurs when this excess reaches a certain limit. Hence if by any suitable means the excess pressure could be relieved, the life of the balloon would be prolonged, and longer, if not higher, ascents could be obtained.

In order to ascertain whether such a valve could function in the manner anticipated, a number of balloons were filled considerably beyond the normal free lift. If the excess pressure increased in manner suggested, a premature burst should occur. The normal free lift given to pilot balloons of about 35 gms. in weight is in the neighbourhood of 70 gms., so that in ascent No. 4 the free lift was about three times the normal. The following are brief details of these ascents :—

Ascent.	Weight of Balloon.	Free Lift.	Time Balloon was Seen.	Height when Lost.
No. 1	21 gms.	120 gms.	55 mins.	30,000 feet
No. 2	35 „	125 „	42 „	23,000 „
No. 3	34 „	160 „	62 „	30,500 „
No. 4	33 „	200 „	19 „	11,600 „

It is interesting to note that none of these balloons was observed to burst. It would thus appear that there is little or no increase of excess pressure as the pilot balloon rises and that a release valve working on the lines suggested would be inoperative.

C. B.

Comparison of Anemometer Exposures at Holyhead

Comparisons have been made recently at Holyhead between the readings of a Dines Pressure Tube Anemograph and those of an anemobiagraph which is situated at a distance of 130 yards to the south of the first instrument, the heads being at the same height.

A preliminary comparison, extending over two separate periods of a month, indicated that there was very close agreement between the instruments for wind speeds above 15 miles per hour but that with light winds the differences were considerable. A further point brought out by the comparison was that the ratio of the velocity recorded by the pressure tube anemometer to that recorded by the anemobiagraph was less for winds from a northerly direction than for southerly winds.

A second comparison extending over three selected months was initiated by Mr. H. L. Pace of the Meteorological Office, Holyhead, who sought to arrive at a relation between the ratio of the wind speeds as recorded by the two anemometers and the

"gustiness" of the wind as deduced from the readings of the pressure tube anemometer. The gustiness factor was taken as (highest gust—lowest lull)/mean hourly wind. The results confirmed those previously obtained and also indicated a considerable variation in the amount of "gustiness" with different wind directions, a result which may be partly explained from a consideration of the exposures of the instruments.

In the diagram the full line shows the position of the low water mark at ordinary tides round Salt Island. The island slopes steeply to the sea except on the south-west side. The extreme

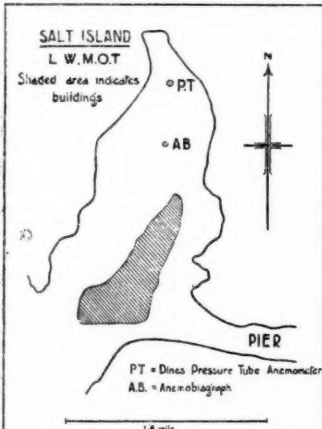


Fig. 1

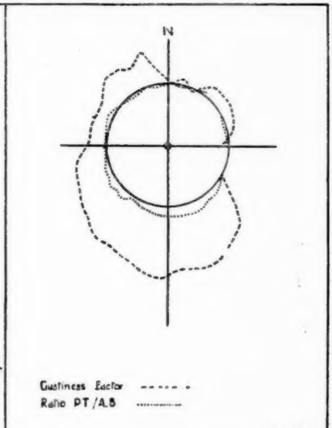


Fig 2

tidal range is about 20 feet. The shaded area on the southern side indicates the position of buildings. The variation in "gustiness" is indicated by the larger of the closed dotted curves, the circle corresponding to a "gustiness" factor of 0·5. The factor varies from 1·04 for southerly winds to 0·41 for easterly winds. The difference in gustiness between winds from northerly and southerly directions is conspicuous. The smaller of the dotted curves indicates the variation of the ratio of the wind speed as recorded by the pressure tube anemograph to that recorded by the anemobiagraph, the circle in this case indicating a ratio of 1·00. The ratio varies from 1·11 for SSE winds to 0·96 for NE winds.

The reduction in the speed of winds from a southerly direction and the increase in gustiness from this direction are probably attributable to the proximity of the buildings to the south of the anemobiagraph. In the case of winds blowing off sea a complication is introduced by the fact that the ground slopes

down steeply from the site of the pressure tube anemometer to the sea. The slope may have the effect of reducing the speed of winds blowing off the sea.

It should be mentioned that both anemometers have been calibrated and found to be in good agreement.

The Rainfall of 1925

The rainfall of 1925 over the British Isles generally was rather more than the average. A comparison is given below of the general rainfall of 1925 with that of each year since the dry year 1921.

RAINFALL—GENERAL DISTRIBUTION.

	1921	1922	1923	1924	1925	
England and Wales	70	105	113	120	—	Per cent.
Scotland	99	94	120	105	—	of the
Ireland	88	92	110	122	—	average
British Isles ..	82	100	114	117	—	1881-1915.

Although the rainfall of 1925 for the British Isles as a whole approximated to the normal yet it contained many interesting features.

In all three countries the areas with rainfall above the average were about as large as those with deficient rainfall. England and Wales experienced less than the average over a wide coastal strip stretching from Canterbury to Hull (including the Fen District), in the Lake District and part of Pembrokeshire. The total fall was only 87 per cent. of the average at Lincoln, 96 per cent. at Seathwaite in Cumberland, and 91 per cent. at Fishguard. More than 120 per cent. of the average occurred on Dartmoor, in parts of Sussex and Hampshire, in the neighbourhood of Bath in Somersetshire, and Kirkby Stephen, in Westmorland. Along the south coast from Newhaven to the Isle of Wight more than 130 per cent. of the average occurred. At Camden Square (London) the fall of 24·91 in. was only ·44 in. or 2 per cent. above the average.

Over Scotland the fall varied from about 85 to 115 per cent. of the average. The values for Aberdeen, Fort William and Glasgow were 89, 90 and 100 respectively. More than the average occurred in three main areas, over the southern Uplands, from the Grampians to the Moray Firth, and in Sutherlandshire.

The range in Ireland was still smaller, the percentage values being generally between 90 and 110. More than the average occurred over the mountains of Wicklow, in the south-west from Valencia to Cahir, from Connemara to Sligo and Roscommon, and also along a north-eastern coastal strip from Londonderry to Belfast.

For the British Isles as a whole the wettest months in 1925 were February and May, but the rainfall of these months was exceeded in the wet years 1923 and 1924 respectively. In Ireland, however, May with 194 per cent. of the average was the wettest May since before 1881. June with only 18 per cent. of the average was the driest month of the year and the driest June since before 1881. The month was rainless in many parts of south England. March with 54 per cent. of the March average and November with 73 per cent. of the November average were also noteworthy. November was especially dry in Scotland being one of the driest Novembers in the series.

The dryness of November in the Fen District and the Thames Valley followed by a normal December total make the floods of the beginning of January 1926 appear all the more remarkable. When the incidence of rainfall is examined it is apparent, however, that the rainfall of December was concentrated into the latter half of the month. In the Thames Valley rain fell on every day from the 19th to 31st amounting to no less than 87 per cent. of the total fall of December, 1925.

Heavy Rainfall

With reference to Mr. Whipple's article " On Rainfall of very rare Intensity,"* it is interesting to note the figures quoted by Dr. J. Boerema, in his paper on the " Extension of Rainshowers at Batavia."† Ten stations in and near Batavia were equipped with recording rain gauges of the Hellmann pattern in the early part of 1923 for the purpose of studying the occurrence of heavy falls of rain in periods up to a few hours. Among other results it was found that the highest rainfall at these ten stations during the period March 1st, 1923, to January 1st, 1925, was :—

	Minutes.		Hours.						
Duration	10	30	1	2	3	4	5	10	12
Rainfall in mm.	25	59	74	89	114	137	158	188	189

Some other records of heavy rain are given in the Report for the Colombo Observatory for 1924. More than 10 in. in 24 hours were measured at several stations on the western or windward slopes of the central mountain range during the rainy season of 1924. A special article is devoted to the heavy rains of September 29th to 30th, when 12 in. occurred on the Maliboda estate and 11·96 in. on the Carney estate. This rainfall was orographical and the distribution was so theoretically correct that the rainfall map would serve as a text book example of that type of precipitation.

The Importance of Field Work in the Study of Climates‡

In a paper bearing the above title, Professor R. de C. Ward, the well-known lecturer in climatology at Harvard, points out how

* See *Meteorological Magazine*, 59 (1924), 149.
† K. Mag. Meteor Obs., Batavia, Verh. 15, 1925.
‡ Proc. Amer. Phil. Soc., 64 (1925), pp. 64-77.

the study of climates may be made interesting. Tables of statistics are, of course, a necessary basis, but they are merely the dry bones, and need to be amplified by vivid descriptions of the "living aspects," such as can only be written by those who have dwelt or travelled in the different regions. Anyone who visits out-of-the-way spots, or even passes through in a train, can help by recording his impressions, especially of the influence of climate on human activities. The teacher of climatology should himself do "field work" by visiting personally as many different types of climate as possible, in order to be able to convey his impressions at first hand. A large collection of lantern slides or cinema films is also essential, in order that the audience in turn may be conducted on an armchair tour through the country under discussion.

New Price List of Barometers Issued by C. F. Casella & Co., Ltd.

In this catalogue a very comprehensive selection of barometers, both mercurial and aneroid, is described and illustrated. The instruments available range from standard precision barometers of a type suitable for Observatories or Standardising Institutions to inexpensive aneroids of the simplest type. Four patterns of barographs of the Meteorological Office "medium" size are also illustrated.

In previous catalogues published by the same firm some interesting information with regard to the internal construction of the various types of barometers was given. The omission of this from the new catalogue, while conducing to greater compactness, is, to some extent, regrettable. Nevertheless, the intending purchaser of a barometer will find much to interest him.

Reviews

Het Klimaat van Nederlandsch-Indië. By C. Braak, K. Magn. Meteor. Obs. Batavia, Verh. No. 8, Vol. 1, Part 8. Size $11 \times 7\frac{1}{2}$, pp. 30 (Dutch) + 24 (English). *Illus.* Batavia, 1925.

The first volume of this important publication has been completed by the issue of part 8, containing the indexes to the Dutch and English parts and some additions to the text. This volume discusses in a scholarly way the meteorological processes which fashion the weather of the Dutch possessions in the East Indies; it forms an excellent introductory textbook in the meteorology of the equatorial regions. The work is published in Dutch with a full English summary, arranged in such a way that the two parts can be bound separately; this excellent arrangement may be commended to the notice of editors of

other bi-lingual series. Part 3 was reviewed in the *Meteorological Magazine* for December, 1923, and parts 6 and 7 in that for March, 1925, so that a detailed account of the contents is not now required.

We learn from the Preface that Volume II. will deal with the local climate of the different islands, and that the third volume will comprise tables of climatological normals.

A Selection of Botanical and other Papers. By the late Jorge V. Perez, M.B., M.R.C.S. 8vo. $8\frac{1}{2} \times 5\frac{1}{2}$, pp. 53. London, Taylor & Francis. 1925.

This little book is mainly for botanists, but contains a few papers of meteorological interest. One of these describes an experiment on the effect of forests on water-supply.

Dr. Marloth exposed two rain-gauges on the summit of Table Mountain, Cape Colony, which is frequently swathed in mist. One of these gauges was normally exposed, while the other contained about twenty small canes. From December 21st, 1902, to February 15th, 1903, the former gauge registered 125 millimetres, the latter as much as 2 metres. It is recorded that in Madeira large amounts of water were formerly obtained by the agency of a certain tree in the cloud belt, whose leaves condensed the moisture and allowed it to drip into cisterns placed beneath. There is a similar "occult" precipitation in the cloud belt of Teneriffe, and the moral is the importance of afforestation. Another paper describes the method of dry farming in Lanzarote, where only a small amount of rain falls in winter. The fields are covered by a thin layer of pumice, which is very hygroscopic and prevents undue evaporation during the dry summer.

News in Brief

We note with much interest that Mr. H. Johnston, of Downpatrick, Ireland, has been a subscriber to the Daily Weather Reports of the Meteorological Office for the past fifty years, and we are sure that our readers will join in congratulating both Mr. Johnston and ourselves on this record.

The Staff of the Meteorological Office, Edinburgh, assisted by members from Eskdalemuir Observatory and Renfrew Aerodrome held a most successful social gathering in Edinburgh on December 19th. The party met for dinner at Ferguson & Forrester's Restaurant and the remainder of the evening was spent in dancing at the *Palais de Danse.* It is hoped that on future occasions members from other stations in Scotland will be able to present.

The Weather of December, 1925

THE cold weather experienced during the greater part of November continued generally during the first week of December with many bright periods and severe frost, 13° F. and 12° F. were registered in the screen at Rhayader and Eskdalemuir on the 4th and 6th respectively, and grass minima fell to 7° F. at Rhayader on the 3rd and 4th, and to 6° F. at Cranwell on the 6th. Fog occurred in many places, notably on the 4th, when it persisted throughout the day in London. Snow, sleet and hail fell generally, and snow-lying to a depth of 4 to 5 in. was recorded at Balmoral on the 6th and 7th, and Norwich on the 8th. On the 5th a deep depression was situated north of the Azores and extended its influence slowly east and north. Southerly winds spread over the British Isles and the temperature rose quickly, the highest reading, 56° F., occurred at Valencia on the 6th. The thaw caused extensive floods in north-east Yorkshire. After the 8th the centre of this deep depression moved east across the north of Scotland, and pressure became high on the Atlantic, re-establishing northerly winds and wintry weather over the British Isles. Snow and sleet occurred in most parts, and in a few places the temperature did not rise above freezing point on the 13th, 14th and 15th. By the 17th the winds became westerly and milder weather set in. This, however, only lasted a short while, as a low pressure area centred off our south-west coasts on the 19th, gradually moved along the English Channel and North Sea to Scandinavia, giving easterly winds backing to north-west, with cold weather from that day until the 25th. Rain and snow occurred generally, the depth of snow reported at Lairg, in Sutherland, being 18 in. On the 19th a screen minimum of 9° F. and a grass minimum of 0° F. were registered at Balmoral, and on the 25th the maximum at Eskdalemuir was only 19° F. With the approach of a depression from the Atlantic the winds became westerly on the 26th, and there was a rapid rise of temperature. Mild rainy weather continued until the end of the month, with gales and high winds from the 29th to 31st. Gusts of 88 m.p.h. and 85 m.p.h. were reported from Southport and Holyhead on the 30th. The heaviest rainfall occurred on the 28th and 29th, 86 mm. (3·40 in.) falling at Llyn Fawr (Glamorgan) on the 28th, and 70 mm. (2·77 in.) at Holne (Devon) on the 29th. As a result of the rapid thaw and subsequent heavy rains, many parts of the country were flooded. The total rainfall was generally below normal in the western districts and above normal in the eastern, the percentage value being as low as 47 at Ardgillan (Dublin) and as high as 178 at Brighton.

Pressure was above normal over Iceland and the Mediterranean, the excess being 12·2 mb. at Isafjord, and 2·2 mb. at Rome, and below normal in a belt extending from the White Sea and the

Faroës to Spain, the Azores and Newfoundland, the greatest deficits being at Horta (13·4 mb.) and in southern Scandinavia (over 10 mb.). This distribution favoured northerly winds. Temperature was low over north-west Europe (the lowest reading in Sweden being −38° F. at Gällivare on the 16th), but as much as 5° F. above normal at Lisbon, while the rainfall was much above normal over Scandinavia and central Europe, but deficient in north Scotland and Spitsbergen. During the first three weeks of the month severe cold and much snow were experienced over the whole of Europe. In Venice certain portions of the lagoon were frozen over by the 6th, and on the 9th the Danube was rapidly freezing over at Budapest. Frosts were even reported from Seville. Owing to the exceptionally severe weather wolves have attacked several villages in northern Italy and central Europe. Between the 21st and 23rd severe gales, accompanied by a rapid rise of temperature, swept across France and Switzerland, causing considerable damage. Violent thunderstorms occurred on the 21st and 22nd along the Jura. By the 23rd much of the snow had disappeared from the lower lying parts of Europe, and heavy rains persisted from then to the 31st. These, in conjunction with the thaw, caused extensive floods in central Europe, Holland, Belgium and France.

At the beginning of the month severe storms were reported from America and the North Atlantic. After a week of mild weather before Christmas, a severe gale swept across New York State from the Middle West on the 24th and 25th, and the temperature fell rapidly.

The rainfall of Australia was generally somewhat below normal, the greatest deficits, about 120 mm. (4·7 in.), occurring on the north coast of Queensland. In southeast Queensland, however, it was slightly below normal.

Owing to the collapse of a sand embankment, due to the heavy rain, a passenger train on the Mayavaram-Avanthangi branch of the South Indian railway was overturned and nine people are reported to have been killed.

The special message from Brazil states that the rainfall in the northern districts was irregular, average 4 mm. above normal, but plentiful in the central and southern districts where the totals were 41 mm. and 31 mm. above normal respectively. More anticyclones of moderate intensity passed across the country than in the previous month. The crops generally were doing well. At Rio de Janeiro pressure was 0·3 mb. above normal and temperature 1·8° F. above normal.

Rainfall, 1925—General Distribution

	Dec.	Year	
England and Wales	103	108	per cent. of the average 1881-1915.
Scotland	89	101	
Ireland	76	98	
British Isles	94	104	

Rainfall: December, 1925: England and Wales

CO.	STATION.	In.	mm.	Per-cent. of Av.	CO.	STATION.	In.	mm.	Per-cent of Av.
Lond.	Camden Square	2·79	71	117	*War.*	Birminghm, Edgbaston	2·44	62	91
Sur.	Reigate, Hartswood	3·25	83	108	*Leics*	Thornton Reservoir	2·44	62	91
Kent.	Tenterden, Ashenden	4·29	109	137	,,	Belvoir Castle	1·85	47	75
,,	Folkestone, Boro. San.	3·85	98	...	*Rut.*	Ridlington	2·10	53	...
,,	Broadstairs, St Peter's	2·24	57	94	*Linc.*	Boston, Skirbeck	1·78	45	83
,,	Sevenoaks, Speldhurst.	3·99	101	...	,,	Lincoln, Sessions House	1·35	34	62
Sus.	Patching Farm	4·93	125	147	,,	Skegness, Estate Office.	...	...	...
,,	Brighton, Old Steyne	5·53	141	178	,,	Louth, Westgate	1·82	46	65
,,	Tottingworth Park	5·22	133	141	,,	Brigg	2·09	53	86
Hants	Ventnor, Roy. Nat. Hos.	4·85	123	147	*Notts.*	Worksop, Hodsock	1·96	50	83
,,	Fordingbridge, Oaklnds	...	...	...	*Derby*	Mickleover, Clyde Ho.	2·32	59	88
,,	Ovington Rectory	4·22	107	106	,,	Buxton, Devon. Hos.	3·40	86	60
,,	Sherborne St. JohnRec.	3·82	97	116	*Ches.*	Runcorn, Weston Pt.	2·41	61	77
Berks	Wellington College	3·11	79	108	,,	Nantwich, Dorfold Hall	2·49	63	...
,,	Newbury, Greenham	3·22	82	101	*Lancs*	Manchester, Whit. Pk.	2·36	60	73
Herts.	Benington House	2·20	56	89	,,	Stonyhurst College	4·41	112	91
Bucks	High Wycombe	2·61	66	89	,,	Southport, Hesketh	2·26	57	70
Oxf.	Oxford, Mag. College	2·08	53	90	,,	Lancaster, Strathspey.	...	...	...
Nor.	Pitsford, Sedgebrook	...	...	...	*Yorks*	Sedbergh, Akay	6·21	158	105
,,	Eye, Northolm	1·79	45	...	,,	Wath-upon-Dearne	2·37	60	100
Beds.	Woburn, Crawley Mill.	1·90	48	81	,,	Bradford, Lister Pk.	5·16	131	154
Cam.	Cambridge, Bot. Gdns.	1·54	39	80	,,	Wetherby, Ribston H.	2·68	68	109
Essex	Chelmsford, CountyLab	2·14	54	96	,,	Hull, Pearson Park	3·13	79	130
,,	Lexden, Hill House	1·88	48	...	,,	Holme-on-Spalding	2·65	67	...
Suff.	Hawkedon Rectory	1·86	47	77	,,	West Witton, Ivy Ho.	5·37	136	...
,,	Haughley House	1·45	37	...	,,	Felixkirk, Mt. St. John	3·04	77	126
Norf.	Beccles, Geldeston	2·21	56	96	,,	Pickering, Hungate	4·09	104	...
,,	Norwich, Eaton	2·53	64	97	,,	Scarborough	4·83	123	203
,,	Blakeney	3·27	83	147	,,	Middlesbrough	2·76	70	142
,,	Swaffham	2·15	55	90	,,	Baldersdale, Hury Res.	...	...	...
Wilts.	Devizes, Highclere	3·29	84	107	*Durh.*	Ushaw College	3·75	95	150
,,	Bishops Cannings	3·04	7	93	*Nor.*	Newcastle, Town Moor.	4·60	117	191
Dor.	Evershot, Melbury Ho.	...	...	...	,,	Bellingham, Highgreen	5·07	129	...
,,	Weymouth, Westham	...	...	...	,,	Lilburn Tower Gdns.	4·82	122	...
,,	Shaftesbury, Abbey Ho.	3·47	88	96	*Cumb*	Geltsdale	3·49	89	...
Devon	Plymouth, The Hoe	5·31	135	106	,,	Carlisle, Scaleby Hall	3·30	84	103
,,	Polapit Tamar	5·48	139	107	,,	Seathwaite M.	12·60	320	78
,,	Ashburton, Druid Ho.	8·70	221	116	*Glam.*	Cardiff, Ely P. Stn.	4·13	105	81
,,	Cullompton	3·99	101	91	,,	Treherbert, Tynywaun	9·68	246	...
,,	Sidmouth, Sidmount	4·68	119	119	*Carm*	Carmarthen Friary	4·54	115	79
,,	Filleigh, Castle Hill	4·23	107	...	,,	Llanwrda, Dolaucothy.	6·94	176	99
,,	Barnstaple, N.Dev.Ath.	...	...	...	*Pemb*	Haverfordwest, School	4·30	109	75
Corn.	Redruth, Trewirgie	5·88	149	94	*Card.*	Gogerddan	4·00	102	79
,,	Penzance, Morrab Gdn.	4·81	122	85	,,	Cardigan, County Sch.	3·79	96	...
,,	St. Austell, Trevarna	7·22	183	118	*Brec.*	Crickhowell, Talymaes	4·10	104	...
Soms	Chewton Mendip	5·35	136	99	*Rad.*	Birm. W.W. Tyrmynydd	6·43	163	78
,,	Street, Hind Hayes	2·63	67	...	*Mont.*	Lake Vyrnwy	8·43	214	122
Glos.	Clifton College	5·29	134	138	*Denb.*	Llangynhafal	3·77	96	...
,,	Rendcomb College	3·50	89	102	*Mer.*	Dolgelly, Bryntirion	5·08	129	74
Here.	Ross, Birchlea	3·19	81	107	*Carn.*	Llandudno	2·56	65	83
,,	Ledbury, Underdown.	3·25	83	116	,,	Snowdon, L. Llydaw 9	15·07	383	...
Salop	Church Stretton	3·27	83	97	*Ang.*	Holyhead, Salt Island.	3·11	79	75
,,	Shifnal, Hatton Grange	2·48	63	97	,,	Lligwy	2·72	69	...
Staff.	Tean, The Heath Ho.	2·68	68	82	*Isle of Man*				
Worc.	Ombersley, Holt Lock.	2·40	61	92		Douglas, Boro' Cem.	4·29	109	87
,,	Blockley, Upton Wold.	2·54	65	78	*Guernsey*				
War.	Farnborough	1·79	45	61		St. Peter P't, Grange Rd	6·34	161	155

Rainfall: December, 1925: Scotland and Ireland

CO.	STATION	In.	mm.	Per-cent. of Av.	CO.	STATION.	In.	mm.	Per-cent of Av.
Wigt.	Stoneykirk, Ardwell Ho	4·08	104	100	*Suth.*	Loch More, Achfary	9·02	229	98
,,	Pt. William, Monreith	4·57	116	...	*Caith*	Wick	2·59	66	84
Kirk.	Carsphairn, Shiel.	8·48	215	...	*Ork.*	Pomona, Deerness	2·49	63	59
,,	Dumfries, Cargen	4·47	113	83	*Shet.*	Lerwick	4·04	103	84
Dum	Drumlanrig	...	...	...					
Roxb	Branxholme	4·20	107	125	*Cork.*	Caheragh Rectory	5·70	145	...
Selk.	Ettrick Manse	5·72	145	...	,,	Dunmanway Rectory	6·28	159	77
Berw.	Marchmont House	3·99	101	142	,,	Ballinacurra	3·23	82	63
Hadd	North Berwick Res.	2·42	61	112	,,	Glanmire, Lota Lo.	3·99	101	72
Midl	Edinburgh, Roy. Obs.	3·35	85	157	*Kerry*	Valencia Obsy.	4·23	107	64
Lan	Biggar	3·22	82	95	,,	Gearahameen	11·00	279	...
Ayr	Kilmarnock, Agric. C.	3·66	93	86	,,	Killarney Asylum	5·07	129	70
,,	Girvan, Pinmore	4·56	116	76	,,	Darrynane Abbey	4·15	105	71
Renf.	Glasgow, Queen's Pk.	3·07	78	73	*Wat.*	Waterford, Brook Lo.	2·82	72	61
,,	Greenock, Prospect H.	4·04	103	51	*Tip.*	Nenagh, Cas. Lough	3·51	89	76
Bute	Rothesay, Ardencraig.	3·71	94	68	,,	Tipperary	3·67	93	...
,,	Dougarie Lodge	2·96	75	...	,,	Cashel, Ballinamona	2·94	75	68
Arg.	Ardgour House	9·09	231	...	*Lim.*	Foynes, Coolnanes	3·42	87	72
,,	Manse of Glenorchy	7·54	191	...	,,	Castleconnell Rec.	2·70	69	...
,,	Oban	3·98	101	...	*Clare*	Inagh, Mount Callan	4·80	122	...
,,	Poltalloch	3·97	101	62	,,	Broadford, Hurdlest'n.	3·56	90	...
,,	Inveraray Castle	6·00	152	60	*Wexf*	Newtownbarry	3·13	79	...
,,	Islay, Eallabus	4·32	110	73	,,	Gorey, Courtown Ho.	2·73	69	71
,,	Mull, Benmore	8·00	203	...	*Kilk.*	Kilkenny Castle	2·28	58	66
Kinr.	Loch Leven Sluice	2·47	63	63	*Wic.*	Rathnew, Clonmannon	2·45	62	...
Perth	Loch Dhu	6·25	159	61	*Carl.*	Hacketstown Rectory	2·55	65	62
,,	Balquhidder, Stronvar.	5·06	129	53	*QCo.*	Blandsfort House	...	...	...
,,	Crieff, Strathearn Hyd.	4·30	109	96	,,	Mountmellick	2·89	73	...
,,	Blair Castle Gardens	3·59	91	94	*KCo.*	Birr Castle	1·70	43	52
,,	Coupar Angus School	3·10	79	103	*Dubl.*	Dublin, FitzWm. Sq.	1·81	46	73
Forf.	Dundee, E. Necropolis	2·57	65	97	,,	Balbriggan, Ardgillan	1·37	35	47
,,	Pearsie House	2·46	63	...	*Me'th*	Drogheda, Mornington	1·36	35	...
,,	Montrose, Sunnyside	1·60	41	58	,,	Kells, Headfort	2·55	65	67
Aber.	Braemar, Bank	4·57	116	128	*W.M*	Mullingar, Belvedere	2·52	64	68
,,	Logie Coldstone Sch.	3·86	98	137	*Long*	Castle Forbes Gdns.	2·46	63	62
,,	Aberdeen, King's Coll.	1·81	46	56	*Gal.*	Ballynahinch Castle	...	...	...
,,	Fyvie Castle	4·46	113	...	*Mayo*	Mallaranny	5·84	148	...
Mor.	Gordon Castle	2·39	61	89	,,	Westport House	3·76	95	65
,,	Grantown-on-Spey	2·30	58	85	,,	Delphi Lodge	5·88	149	...
Na.	Nairn, Delnies	1·85	47	83	*Sligo*	Markree Obsy.	3·66	93	77
Inv.	Ben Alder Lodge	7·45	189	...	*Cav'n*	Belturbet, Cloverhill	2·28	58	78
,,	Kingussie, The Birches	3·60	91	...	*Ferm*	Enniskillen, Portora	...	...	...
,,	Loch Quoich, Loan	14·10	358	...	*Arm.*	Armagh Obsy.	2·51	64	80
,,	Glenquoich	...	...	...	*Down*	Warrenpoint	2·46	63	...
,,	Inverness, Culduthel R.	2·54	65	...	,,	Seaforde	3·55	90	86
,,	Arisaig, Faire-na-Squir	4·14	105	...	,,	Donaghadee, C. Stn.	3·19	81	100
,,	Fort William	8·52	216	85	,,	Banbridge, Milltown	2·65	67	95
,,	Skye, Dunvegan	7·21	183	...	*Antr.*	Belfast, Cavehill Rd.	4·11	104	...
,,	Barra, Castlebay	2·59	66	...	,,	Glenarm Castle	4·56	116	...
R&C	Alness, Ardross Cas.	4·74	120	115	,,	Ballymena, Harryville	4·10	104	92
,,	Ullapool	6·32	160	...	*Lon.*	Londonderry, Creggan	5·08	129	116
,,	Torridon, Bendamph	9·53	242	95	*Tyr.*	Donaghmore	4·13	105	...
,,	Achnashellach	9·98	253	...	,,	Omagh, Edenfel	3·60	91	85
,,	Stornoway	5·74	146	92	*Don.*	Malin Head	4·07	103	121
Suth.	Lairg	4·46	113	...	,,	Rathmullen	5·47	139	...
,,	Tongue Manse	4·54	115	92	,,	Dunfanaghy	5·51	140	108
,,	Melvich School	4·66	118	108	,,	Killybegs, Rockmount	5·51	140	76

Climatological Table for the British Empire, July, 1925

57

STATIONS	PRESSURE Mean of Day M.S.L.	PRESSURE Diff. from Normal	TEMPERATURE Absolute Max.	Absolute Min.	Mean Values Max.	Mean Values Min.	Mean Values ½ max. and min.	Mean Values Diff. from Normal	Mean Wet Bulb.	Relative Humidity	Mean Cloud Am'nt	PRECIPITATION Am'nt	Diff. from Normal	Days	BRIGHT SUNSHINE Hours per day	Percentage of possible.
	mb.	mb.	° F.	° F.	° F.	° F.	° F.	° F.	° F.	%	0—10	mm.	mm.			
London, Kew Obsy.	1013·7	− 2·1	87	49	73·4	55·6	64·5	+ 1·8	57·4	84	6·5	100	+ 45	13	6·0	38
Gibraltar	1016·6	− 0·2	87	60	78·7	64·4	71·5	− 3·3	62·8	78	5·4	5	+ 4	1	...	...
Malta	1015·6	+ 0·3	92	65	83·2	70·8	77·0	− 1·3	70·6	74	2·1	0	− 1	0	11·3	79
Sierra Leone	1013·9	+ 0·5	88	67	82·6	71·7	77·1	− 1·9	74·8	86	7·6	780	− 96	28	...	...
Lagos, Nigeria	1011·7	− 2·1	87	70	84·6	73·6	79·1	+ 1·8	75·2	83	7·8	387	+118	15	...	...
Kaduna, Nigeria	1014·2	+ 0·2	90	...	84·0	...	...	...	68·9	81	2·4	386	+178	19	...	...
Zomba, Nyasaland	1018·8	+ 0·3	79	46	71·6	53·0	62·3	+ 0·4	...	82	6·7	14	+ 6	5	...	...
Salisbury, Rhodesia	1020·3	− 0·5	77	36	69·3	43·3	56·3	+ 0·2	49·7	61	2·2	2	+ 1	3	8·6	77
Cape Town	1022·0	+ 1·2	77	39	62·3	49·1	55·7	+ 1·0	50·3	83	5·3	102	+ 6	15	...	...
Johannesburg	1025·5	+ 0·3	69	30	59·9	38·5	49·2	− 1·4	39·5	61	2·0	5	− 1	2	8·9	84
Mauritius	1020·6	+ 0·2	78	58	75·9	62·2	69·1	+ 0·8	71·1	73	5·4	61	− 2	23	6·9	63
Bloemfontein	...	...	71	19	60·8	31·2	46·0	− 1·3	36·8	73	3·2	1	− 9	1	...	...
Calcutta, Alipore Obsy.	999·3	+ 0·1	93	76	87·7	78·8	83·3	− 0·2	78·8	89	9·2	451	+133	22*	...	...
Bombay	1005·2	+ 1·3	88	77	85·8	78·6	82·2	+ 0·9	77·3	82	8·1	213	−403	16*	...	...
Madras	1005·8	+ 1·3	104	72	96·3	79·2	87·7	+ 0·3	75·2	60	7·0	97	− 3	6*	...	...
Colombo, Ceylon	1010·1	+ 0·9	87	71	85·8	76·7	81·3	+ 0·2	77·7	75	8·3	146	− 18	13	7·0	56
Hong Kong	1004·2	− 0·6	92	74	87·8	78·3	83·1	+ 0·6	78·5	75	6·7	525	+185	17	8·7	65
Sandakan	...	...	91	72	87·1	74·9	81·0	− 0·9	75·5	81	...	208	+ 42	15	...	...
Sydney	1015·5	− 2·9	69	41	62·0	45·1	53·5	+ 1·0	46·6	74	3·5	6	−120	6	6·8	67
Melbourne	1016·9	− 2·2	61	31	54·1	42·3	48·2	− 0·4	44·3	84	7·8	59	+ 13	21	2·6	26
Adelaide	1019·3	− 1·1	67	38	59·2	45·8	52·5	+ 0·9	47·7	79	8·1	54	− 13	22	4·0	40
Perth, W. Australia	1021·8	+ 2·8	69	37	62·1	45·1	53·6	− 1·6	48·8	75	4·9	175	+ 9	16	5·9	58
Coolgardie	1022·4	+ 2·5	72	32	60·5	38·8	49·7	− 1·5	43·3	67	2·6	7	− 16	4	...	...
Brisbane	1017·9	− 0·5	75	37	67·2	46·4	56·8	− 1·7	49·2	68	2·9	18	− 41	4	8·3	79
Hobart, Tasmania	1012·9	− 0·9	60	31	51·2	39·3	45·3	− 0·1	40·6	82	7·7	78	+ 24	15	4·3	46
Wellington, N.Z.	1012·8	− 0·1	61	32	53·4	43·9	48·7	+ 1·0	46·1	83	7·3	111	− 35	19	3·2	34
Suva, Fiji	1013·0	− 1·2	86	60	77·3	65·5	71·4	− 2·2	68·0	81	6·1	177	+ 60	15	...	...
Apia, Samoa	1012·9	+ 0·9	87	67	83·7	72·5	78·1	+ 0·9	74·1	74	4·4	36	− 31	9	7·8	68
Kingston, Jamaica	1014·9	+ 0·2	92	70	90·0	72·6	81·3	− 0·4	71·5	79	3·5	14	− 28	2	...	...
Grenada, W.I.	1014·8	+ 1·5	88	72	84·4	74·3	79·3	+ 0·4	75·6	81	6·6	192	− 57	27	...	...
Toronto	1013·0	− 1·1	88	46	77·0	58·0	67·5	− 0·7	60·2	69	4·6	89	+ 12	10	8·7	58
Winnipeg	1014·3	+ 1·6	93	45	78·3	54·9	66·6	+ 0·4	58·1	80	3·7	15	− 62	9	9·5	60
St. John, N.B.	1012·4	− 1·3	78	45	68·2	52·8	60·5	+ 0·1	56·4	84	7·0	85	− 7	16	5·6	37
Victoria, B.C.	1018·2	+ 1·5	75	49	67·7	49·0	58·3	− 2·0	55·0	76	3·	4	− 5	2	12·5	80

*For Indian stations a rain day is a day on which 0·1 in. (2·5 m[illegible] rain [illegible]as fallen.

[illegible]	[illegible]	[illegible]	55	43	78·3	54·9	66·6	+ 0·4	58·1	80	3·7	15	− 62	9	9·5	60
St. John, N.B.	1012·4	− 1·3	78	45	68·2	52·8	60·5	+ 0·1	56·4	84	7·0	85	− 7	16	5·6	37
Victoria, B.C.	1018·2	+ 1·5	75	49	67·7	49·0	58·3	− 2·0	55·0	76	3·	4	− 5	2	12·5	80

*For Indian stations a rain day is a day on which 0·1 in. (2·5 m[illegible] rain [illegible]as fallen.